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ECONOMIC GROWTH AND EDUCATION: A NEW INTERNATIONAL POLICY

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ABSTRACT: First of all this paper presents a world wide view of economic growth and education in 1994, with data of population, gross domestic product per head, and public expenditure on education per head for 199 countries grouped in 40 geographical areas. In the second place the paper present an international production function that includes both physical capital and human capital, measured by the stock of population with secondary education of second level complete, as factors of production. The model was fitted with data of 37 countries, of different levels of development, and shows a good fit and the significativeness of the coefficient of both variables. Education has a positive influence in economic development

As many countries are very far below the world average of production and education expenditure by inhabitant, measured in purchasing power parities around 5620 dollars for production and 257 for education expenditure by inhabitant, the only way to improve their situation is to foster international co-operation, as many of those countries are unable to cope with their challenges because they are so poor. Education has a positive influence on economic growth also reducing excesses in fertility average rates, creating a social environment that improve productive investment, making workers more productive and voters more prepared to choose a good government and promote reasonable socio-economic policies. The international co-operation should improve also, where needed, better quality in education contents of human values, promoting respect to peace, human rights and equality

for women, as well as the learning of one or more widely spoken world languages to avoid isolation and promoting the access to a greater wealth of information.

1.- EXPENDITURE ON EDUCATION AND GDP PER HEAD IN 1994

First of all we can analyze the standard of living, measured by Gross Domestic Product per head in real international terms (GDPH), using Purchasing Power Parities (PPPs), from the data from CORDELIER and DIDIOT(1996), for the year 1994, together with the expenditure on education per head (EDUH).

We distinguish the 40 geopolitical areas that figure in Table 1. This classification is the same as that in Cordelier and Didiot with only two exceptions: 1) We distinguish two areas in North East Asia instead of only one. 2) We enclose the groups "South Pacific" and "South Pacific Isles" in a single group.

Table 1 shows the population (in thousands), GDP per head in 1994 and Public Expenditure on Education per inhabitant.

The World average was 5620 US dollars per head and public expenditure on education per head was US$ 257. The World average in 1994 was greater than that in 1970 or 1980, which means a great increase in world production as the world population has experienced a substantial growth. Although it may seem a miracle that our world has the capability of sustaining almost 10 times the population of 300 years ago, with a standard of living higher than then, we must stand out our worries because many millions of people in all continents have very bad living conditions not only in a physical sense but also in a psychologically, as the violence and the lack of elemental justice is very widespread.

The United Nations has a commitment to strive for a much better world, with a standard of living above the present world average as a minimum for all countries, and development of laws, and their application, for the effective respect of human rights and the eradication of all types of physical and psychological violence.

UNESCO, as a special organization for education has great challenges at the end of

20th century in order to improve the situation of Low Development Countries (LDCs) and regions with low level of education. This is crucial to help these countries to attain a sustained growth, as the level of education has very important consequences on development.

Table 1

AREA	POP95 (Thousand)	GDP94H ($ per head)	EDUH ($ per head)
1. MAGREB	72155	4517	309
2. SAHEL	36512	698	16
3. FAR WEST AFRIC	24864	1392	42
4. GUINEA GULF	153102	1487	26
5. CENTRAL AFRICA	64946	830	25
6. EAST AFRICA	95764	934	46
7. N.W. AFRICA	70038	452	23
8. NILE VALLEY	87328	2882	144
9. SUDTROPICAL AF.	57766	967	57
10. AUSTRAL AF.	47200	3818	268
11. INDIAN OCEAN	17259	1840	98
12. FERTILE CRESCENT	50578	5394	264
13. ARABIAN PENINSULA	39685	4410	218
14. MIDDLE EAST	217674	2833	114
15. INDIA AND PERIPH.	1098341	1322	46
16. INDOCHINA	196415	2741	99
17. S.E. INSULAR ASIA	285585	4024	87
18. N.E ASIA G1	1247789	2480	48
19. N.E ASIA G2	197854	17989	842
20. SOUTH PACIFIC	27540	15384	896
21. NORTH AMERICA	387420	20911	1157
22. CENTRAL AMERICA	33149	3526	104
23. GREAT ANTILLES	32641	3244	163
24. LITTLE ANTILLES	2858	7873	573
25. VENEZUELA-GUYANAS	23045	7619	416
26. ANDEAN AMERICA	77505	4712	137
27. SOUTH CONE	212627	6365	259
28. GERMAN EUROPE	96679	20711	898
29. BENELUX	25969	20105	1112
30. NORTH EUROPE	23857	19447	1536
31. BRITISH IS.	61838	18248	958
32. LATIN EUROPE	165332	17981	968
33. EAST MEDITERRANEAN	73199	6595	192
34. BALCANES	34890	3178	134
35. EX-YUGOESLAVIA	23658	2204	135
36. CENTRAL EUROPE	64500	6038	349
37. BALTIC COUNTRIES	7750	3938	222
38. EAST EUROPE	214073	4722	224
39. TRANSCAUCASIAN	16717	1638	96
40. CENTRAL ASIA	54042	2389	196

TOTAL WORLD	5710000	5620	257

In the 199 countries belonging to there 40 areas the correlation between GDP per head and Expenditure on education per head is as high as 86.35%. This happens not only because the higher the value of GDPH the greater the possibly of expenditure on education but also because countries with good educational level, and also high expenditure on education, have more possibilities of increasing GDPH. In fact, as we will see later the correlation between GDPH and human capital, measured by the percentage of population with secondary second cycle of studies completed or higher, is as high as 90.80%.

The World average of GDP per head in 1994 is very similar to that of Spain in 1962, at the beginning of its most important phase of growth (1960-1974) and it is not a great standard because many social and family needs cannot be easily met at that level. Nevertheless, it should be a good minimum goal for the poorest countries. The world average of Education Expenditure per head in 1994 is rather low, about 16% of that of the US and other countries with the highest levels of real GDPH, and it means approximately 1/3 of the average expenditure of 17 OECD countries in 1976.

Many countries are very far from the world average in both variables, as well as in the physical capital stock per head. A synthesis of the situation in the different areas is as follows:

In the areas 1 to 11, corresponding to Africa and Indian Ocean, very few countries are above World averages in the values of GDP94H and EDUH. These are: Algeria, Libia in Area 1, Botswana in Area 10 and the islands of Mauritius and Reunion in area 11. The majority of the other countries show very low levels both in standard of living and education expenditure.

In areas 12 to 20, corresponding to Asia and the South Pacific, the levels are generally higher than in Africa. There are important differences, mainly related with the levels of past investment (physical capital stock) and past expenditure in education (human capital).

In areas 21 to 27 corresponding to America we observe the same great differences as in Asia, although they are generally more moderate.

In areas 28 to 32, corresponding to West Europe, the levels are very high while in areas 33 to 40, corresponding to ex-USSR, Eastern European and Central Asian countries the levels are rather low with few countries over World averages.

There exists a great correlation between human capital and GDP per head, as shown in ARRANZ et al.(1997) and CANCELO and GUISAN(1997), both if we measure the human stock of capital by means of accumulated expenditure or by means of a measure of the number of educated people, as a percentage of people with secondary education or average years of schooling.

On the other hand we can see in Table 1 that there exists a great correlation between GDP per head the amount of public money devoted to education. In a dynamic perspective the expenditure of each year means more human capital for the future, which is an investment for future growth. From DENISON(1964) many authors have been preoccupied by education as a factor of production.

2.- AN ECONOMETRIC CROSS-SECTION MODEL THAT RELATES ECONOMIC GROWTH WITH INVESTMENT AND EDUCATION

In this section we present a cross-section econometric model of 37 countries, including Low Development Countries (LDCs), New Industrialized Countries (NICs) and OECD industrialized countries. The aim of fitting this model is to establish a relation between GDPH and the stock of capital, including as explanatory variables both the Stock of physical capital in machinery, equipment and infrastructures (SK94H), expressed in dollar per head, and the Human Capital, measure by means of PS2 what is the percentage of population over 25 with level of education equal to completion Secondary School or higher level.

The results of two estimations figure in the next Tables 2 and 3. In both we can see the high goodness of fit, with R-square over 0.90, and the significance of both explanatory variables as the t-Statistics take values high enough. The second table includes some Dummy variables with the number of the country where it applies. The significance of D19 and D20

may be due to other factors such as R&D expenditure or to the provisional character of the estimation of Sk94H. In the case of D29 and D30 we think that the values of GDP94H of Spain and Portugal are rather overvaluated, and in the case of D37, Russia, the more plausible explanation is that the value of PS2 overvalues the stock of Human Capital as we can deduce if we observe the low value of EDUH in Table 1. In a more complete model it should be interesting to include also a measure of quality of education and expenditure devoted to this investment in human capital.

From these good results, which can be appreciated in the graphs, we can conclude that both types of capital are of importance for sustained growth.

The data shown in Table 1 indicate that the low level of production of many countries and areas make it impossible for poor countries to get a level of investment per head and year near the world average. In the group of 37 countries of the model the average of investment in physical Stock of Capital per head in 1994 was $2646 per capita, with a minimum of 65 and a maximum of 6832. The average investment in Human capital per head of population in the world was $265, and the values in richer countries are around $1000 . These quantities are very much beyond the real possibilities of the poorest countries, but their growth and their lives depend on an international action to help them to increase their factors of production, specially education.

Table 2

LS // Dependent Variable is GDP94H
Sample: 1 37
Included observations: 37

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1017.362	719.2752	1.414427	0.1663
SK94H	0.117376	0.020011	5.865453	0.0000
PS2	133.6470	27.70888	4.823255	0.0000

R-squared	0.908770	Mean dependent var	12024.24
Adjusted R-squared	0.903404	S.D. dependent var	7813.359
S.E. of regression	2428.384	Akaike info criterion	15.66757
Sum squared resid	2.00E+08	Schwarz criterion	15.79818
Log likelihood	-339.3507	F-statistic	169.3431
Durbin-Watson stat	1.556665	Prob(F-statistic)	0.000000

Table 3

LS // Dependent Variable is GDP94H
Sample: 1 37
Included observations: 37

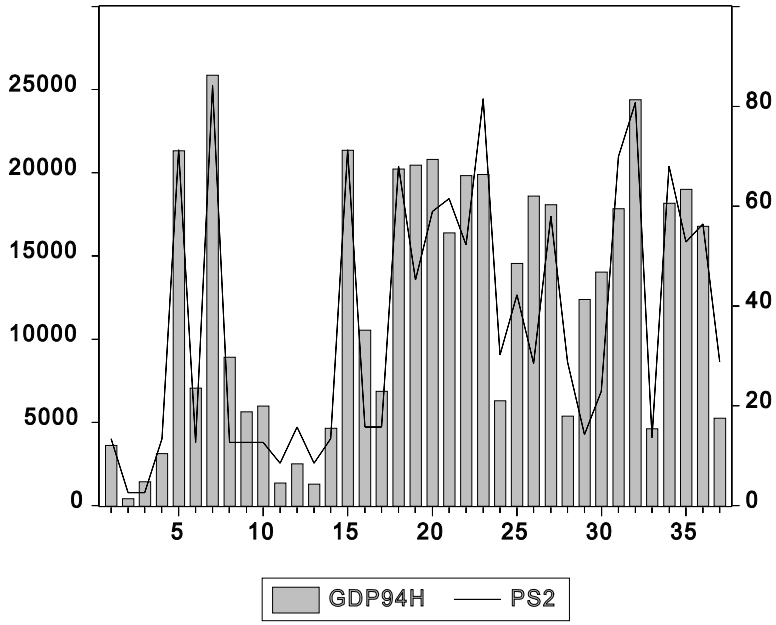
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	626.8023	579.5961	1.081447	0.2884
SK94H	0.080000	0.017297	4.625067	0.0001
PS2	184.3460	23.67241	7.787376	0.0000
D19	3965.990	2001.314	1.981693	0.0571
D26	6774.162	2002.414	3.382997	0.0021
D29	5782.699	1958.239	2.953010	0.0062
D30	4924.492	1948.385	2.527474	0.0172
D37	-3116.596	1921.259	-1.622164	0.1156

R-squared	0.953317	Mean dependent var	12024.24
Adjusted R-squared	0.942049	S.D. dependent var	7813.359
S.E. of regression	1880.918	Akaike info criterion	15.26784
Sum squared resid	1.03E+08	Schwarz criterion	15.61615
Log likelihood	-326.9558	F-statistic	84.60146
Durbin-Watson stat	1.641005	Prob(F-statistic)	0.000000

Graph 1

Gross Domestic Product per head and level of education in 37 Countries

Year 1994



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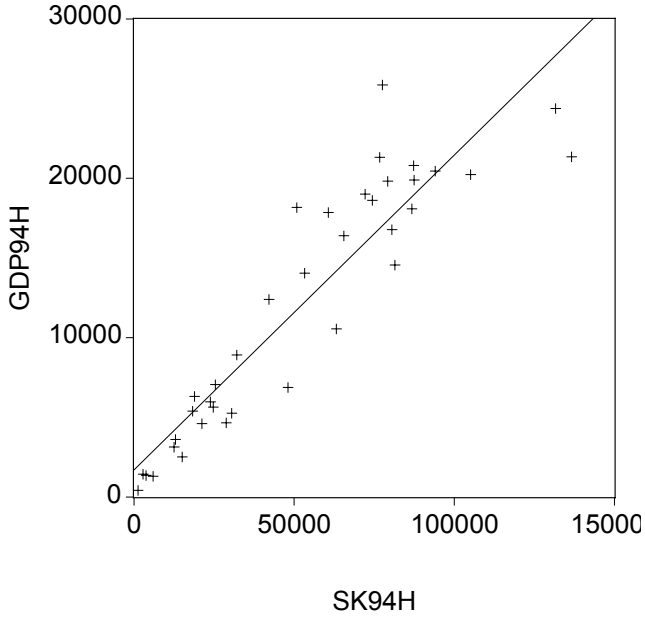
Graph 2



3.- THE IMPORTANCE AND URGENCY OF EDUCATION EXPENDITURE IN ALL COUNTRIES

The level of education, analyzed in BARRO and LEE(1993) and (1996), as well as in NEHRU et al.(1995) and other authors, has increased with time but the movement upwards is so slow in some areas that it is necessary and urgent an international policy.

The real convergence at world level is very slow, as we can see in GUISAN and NEIRA (1997), using the criteria β and σ from SALA-I-MARTIN (1994) this lack of convergence is due mainly to differences in the physical and human capital stocks and the rate of population growth, being the poorest countries which have generally the highest rates of fertility, and the lowest investment per head as well as less mean school years per inhabitant.

Table 4 summarizes de situation of mean school years of the population over 15 in some areas, according to BARRO and LEE(1996), from which we can conclude that a lot of work needs to be done if we want to improve the standards of living of most of the World. This is urgent because the change in education takes several years.

Table 4

Average School Year of Education

	BARRO and LEE		NERUH et al.
AREA	1970	1990	1987
Developing Countries	2.66	4.43	4.48
Middle East and North Afr.	2.05	4.47	4.79
Sub-Saharian Africa	2.06	2.93	2.54
Latin America	3.82	5.24	5.52
East Asia and South Pacific	3.80	6.08	5.13
South Asia	2.03	3.85	3.39
OECD	7.58	9.02	10.0

Source: BARRO and LEE(1996), population over age 25.
NERUH et al. (1995), population between the ages 15-64.

The main urgency, in my opinion, is to generalize at least primary school, with a good quality and if possible with learning of some highly spoken language of the world in order to let access to a lot of information. This urgency is very important due to the need to moderate the high rates of natality of many of the poorest countries in order to get a real increase of the standard of living. As ARRANZ et al.(1997) have shown with data from Latin America the number of illiterate people is highly correlated with excessively high levels of fertility. This policy should include not only child education but also adult education.

The second urgency is to try to improve the expenditure in secondary education as this has been demonstrated as very important to increase GDPH and to introduce new initiatives in production. Obviously international help must include attention to the quality of education in all levels, including tertiary education and Universities as quality of the highest educated is very important for the direction of enterprises and the public sector.

International help should be highly increased if we can get the governments of the richest countries to have a policy of tax-free contributions to international Funds private and public, devoted to investment, education and other social needs of poorest countries. This founds should be used always in policies which respect Peace, Human Rights and Equality of Women.

ANNEX

Relation of countries belonging to each Area in Table 1:

1.-Magreb (Algeria, Libia, Morocco, Mauritania and Tunisia). 2.-Sahelian Africa (Burkina Faso, Mali, Niger and Chad). 3.-Far West Africa (Cabo Verde, Gambia, Guinea, Guinea Bissau, Liberia, Senegal and Sierra Leona).4.-Guinea Gulf (Benin, Ivory Coast, Ghana, Nigeria, and Togo). 5.-Central Africa (Camerun, Central Africa Rep., Congo, Gabón, Equatorial Guinea l, St.Tomé and Principe, exZaire). 6.-East Africa (Burundi, Kenya, Uganda, Ruanda, and Tanzania. 7.-North East Africa (Djibouti, Eritrea, Ethiopia and Somalia). 8.-NILE VALLEY (Egypt and Sudan). 9.-Sub-tropical Africa (Angola, Malawi, Mozambique,

Zambia and Zimbabwe. 10.-Austral Africa (South African Rep., Botswana, Lesotho, Namibia and Swaziland. 11.-Indian Ocean (Comores, Madagascar, Mauritius, Reunion and Seychelles. 12.- Fertile Crescent (Irak, Israel, Cisjordania, Gaza, Jordan, Libano and Syria). 13.-Arabian Peninsula (Saudi Arabia, Bahrein, United Arab Emirates, Kuwait, Oman, Qatar and Yemen). 14.-Middle East (Afganistán, Irán and Pakistán). 15- India and periphery (Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka). 16.-Indochina (Cambodia, Laos, Myanmar, Thailand and Vietnam). 17.-South East Insular Asia (Brunei, Indonesia, Malasia, Philippines and Singapore). 18.-NOrth East Asia, Gropu 1 (China, North Korea and Mongolia). 19.-North East Asia, Group 2 (Hong-Kong, Macao, Taiwan, South Korea and Japan). 20.- South Pacific (Australia, New Zealand, New Caledonia, Fiji, Kiribati, Nauru, Papua-New Guinea, Samoa Is., Salomon Is., Tonga, Tuvalu and Vanuatu). 21.- North America (Canada, USA and Mexico). 22.- Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama). 23.-Greater Antilles (Bahamas, Caiman Is., Cuba, Haití, Jamaica, Puerto Rico and Dominican Rep.). 24.-Lesser Antilles (Antigua y Barbuda, Barbados, Granada, Guadalupe, Martinica, St.Lucía, ST.Vincent and Gren., Trinidad and Tobago). 25.-Venezuela and Guyanas (Guyana, French Guyana, Surinam and Venezuela). 26.-Andean America (Bolivia, Colombia, Ecuador and Peru). 27.- South Cone (Argentina, Brazil, Chile, Paraguay and Uruguay). 28.-Germam Europe (Alemania, Austria, Liechtenstein and Switzerland). 29.-Benelux (Belgium, Luxembourg and Netherlands). 30.-Northern Europe (Denmark, Finland, Greenland, Iceland, Norway and Sweden) 31.-British Is. (Ireland and United Kingdom). 32.-Latin Europe (Andorra, France, Spain, Italy, Monaco, Portugal and St. Marino). 33.-East Mediterranean (Cyprus, Greec, Malta and Turkey). 34.-Balkans (Albania, Bulgaria and Rumania). 35. Ex-Yugoeslavia (Eslovenia, Croacia, Bosnia-Herzegovina., Serbia-Montenegro and Macedonia). 36.-Central Europe (Hungary, Poland, Checa Rep. and Slovakia). 37. Baltic Countries (Estonia, Letonia and Lithuania). 38.-East Europe (Belorussia, Russia, Ukraine and Moldavia). 39.-Transcaucasia (Armeina, Azerbaizan and Georgia). 40.-Central Asia (Kazatstan, Turkmenistan, Uzbekistan, Tayikistan and Kirguizstan).

The countries of the sample in section 2 are numbered as follows:

1.-Egypt	11.-Bangladesh	21.-Finland	31.-Sweden
2.-Ethiopia	12.-China	22.-France	32.-Switzerland
3.-Nigeria	13.-India	23.-Germany	33.-Turkey
4.-South Africa	14.-Iran	24.-Hungary	34.-United Kingdom
5.-Canada	15.-Japan	25.-Ireland	35.-Australia
6.-Mexico	16.-South Korea	26.-Italy	36.-New Zealand
7.-USA	17.-Thailand	27.-Netherlands	37.-Russia
8.-Argentina	18.-Austria	28.-Poland	
9.-Brasil	19.-Belgium	29.-Portugal	
10.-Colombia	20.-Denmark	30.-Spain	

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